How do wastewater heat recovery systems work, and are they practical to install in a new home?

A Steven Baczek, a residential architect from Reading, Mass., who specializes in designing durable, low-energy homes, responds: Whenever we shower, we infuse water with energy to heat it, use it for about two seconds, and then send that warm water—and all that energy—literally right down the drain. It is estimated that somewhere between 80% and 90% of the energy used to heat water ends up going down the drain with the wastewater.

But it doesn't have to be that way. With a drain water heat recovery (DWHR) system, we can recover some of the energy lost as that hot water drains away. I try to talk clients into installing DWHR systems on all of the projects I work on these days. And because DWHR systems have no pumps or moving parts, require no regular maintenance, and add very little to an overall budget—all while offering measurable energy savings—my clients are quickly on board.

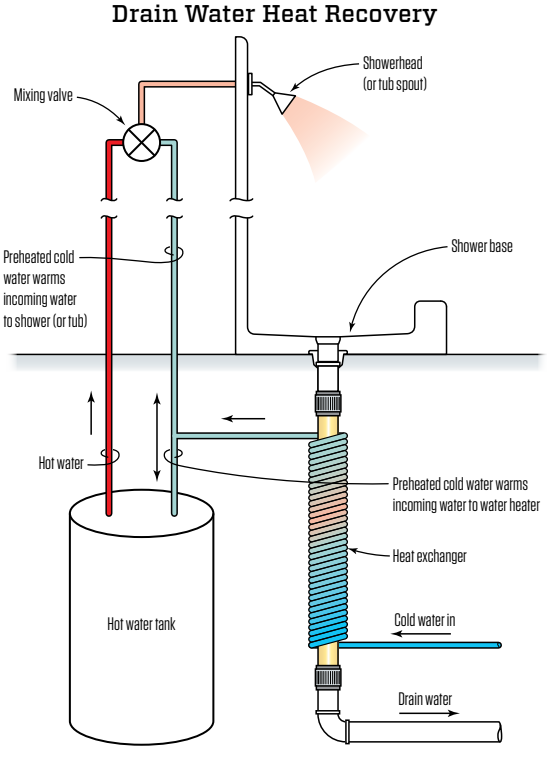
A DWHR system consists of a central drain pipe, usually copper, and a series of formed-coil pipes tightly wrapped around it. This type of system is sometimes referred to as a "double-wall heat exchanger." The double-wall design ensures that the draining greywater never mixes with any of the incoming potable cold water.

Because the system is mounted vertically, the warm greywater clings as a thin film to the inside of the drain pipe as it flows down and through. Heat from the wastewater is then recovered and transferred to the cold water coming in through the coils. Some companies boast a temperature rise as high as 25°F. While that may seem to be extreme, there is no doubt that the system does have a positive impact on the amount of energy used in heating water.

To plumb the DWHR device into a home's wastewater system, there are basically two setups. The first option runs the incoming warmed water directly to the water heater. On the drain side, the heat exchanger can be hooked up to one shower drain exclusively or possibly to a number of drains from fixtures and appliances that converge into a single drain. The perceived advantage of latter approach is having multiple drain outlets to recover heat from.

The most critical consideration to this setup is the length of drain systems before they converge into the DWHR system. Longer pipes allow wastewater to lose more of its heat before entering the DWHR system, but continuous pipe insulation on the drain can help to counteract this loss. According to the experts, this arrangement seems to work best with at least three full-time occupants in the home.

The second configuration is more of a concentrated, or point-of-use, setup. It places a DWHR system directly downstream of the shower drain. The coiled pipes



As warm water drains from the shower, it clings to the sides of a central drain pipe. Incoming water runs through tight coils around the pipe and recovers heat from the drain water. The warmed water then feeds the water heater and the shower.

Illustration: Tim Healey

from the DWHR system are then plumbed into the cold water supply for the shower. In this setup, the recovered heat is transferred directly to the cold water supply for that shower, which means that the water enters the mixing valve at a higher temperature, and less water from the water heater is required to raise the overall temperature to a comfortable showering level. The biggest advantages to this highly concentrated system are that heat losses from long lengths of drain pipe are completely eliminated, and the plumbing layout is straightforward.

There are many DWHR units on the market and costs can vary depending on the sizes of the pipes you choose. Most come in at less than $1,000. Most companies say that you can recover the cost of a system in as little as two years depending on the energy costs in your area and on how much hot water you use. But regardless of the payback time, it's great way to save energy in a home, and the "set and forget" passive operation of the units makes them non-intimidating for your homeowner clients.

Q I enjoyed the article on copper roofing ("Installing a Flat-Seam Copper Roof," May/16*).* I have always "pre-tinned" copper panels before installing them. Is this necessary?

A Kyle Diamond, a partner in New Dimension Construction, in Millbrook, N.Y., responds: "Tinning" is the practice of applying solder along the edges of copper panels before bending them to create the interlocking edges that I describe in the article. Tinning helps to ensure that there are no voids in the soldered joints between the copper panels where moisture might be allowed to enter.

Tinning is essentially a way of creating a foolproof installation, and I'd recommend it as a good practice, especially for beginners.

I have been soldering joints in copper roofing for years, and one of the biggest keys to creating successful and long-lasting solder joints is to control the heat of the soldering iron. I am also meticulous about cleaning the joints before applying the solder. Any contaminants in the joints, including debris such as sawdust, can be a recipe for failure.

Q I enjoyed the "Tiny Bathroom" article in the December 2015 issue. The toilet with the tank in the wall was very interesting, but was any access provided to get to the tank for future maintenance?

A Daniel Lewis, an architect based in Northborough and Centerville, Mass., responds: The in-wall tank for the Toto toilet was installed in a wall shared by a basement stairway. In that particular old house, the covering on the stairway side of the wall was tongue-and-groove beadboard. If a problem did develop with the plumbing connections, accessing the tank would be fairly easy and minimally invasive. But even if the tank were mounted on a wall with drywall on both sides, cutting open the wall to access the connections would still not be difficult. Plumbing connections concealed in a wall are also common with most shower valves (including the shower in the tiny bathroom).

As far as accessing the guts of the tank, that is done through the push plate where you activate the flush mechanism. The installation manual has detailed instructions for removing the plate and pulling out the flushing mechanism inside. So far, that operation has not been required; if it ever is, I would call on the plumber who installed the toilet. But the toilet has been working flawlessly, and I'm not banking on any problems for at least the next 20 years.